Curso: Técnicas de muestreo para el estudio y manejo de vertebrados terrestres

Anfibios (II)

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¿Por qué debería preocuparnos si perdemos anfibios?

Es por las mismas razones básicas por las que deberíamos preocuparnos si otros animales y plantas desaparecen: economía, función del ecosistema, estética y ética.

(Noss and Cooperrider 1994; Groom *et al.* 2006)

Establecer la pregunta y los objetivos del estudio

¿Dónde y cuándo**?** Definiendo la escala espacial y temporal del estudio

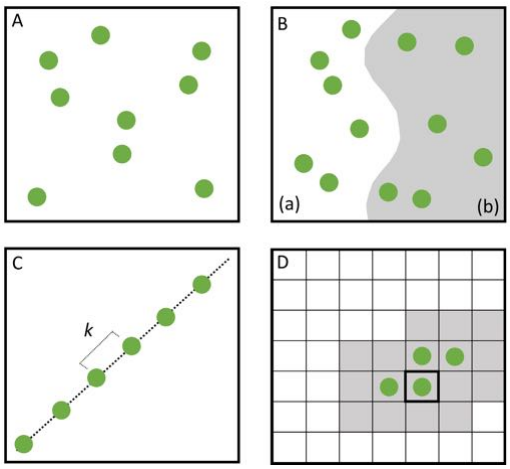
¿Cuánto**?** Definiendo el tamaño de la muestra

Muestra representativa de la población
Número de réplicas de las unidades experimentales (individuos, poblaciones, especies, parches de hábitat, entre otros)

- **Inventarios de fauna**: describir y/o cuantificar la fauna de una localidad
- **Monitoreos de fauna**: describir y/o cuantificar cómo varía en el tiempo la fauna de una localidad

¿Cómo**?** Diseños de muestreo estandarizados

A. Muestreo aleatorio simple
B. Muestreo aleatorio en bloques o estratificado
C. Muestreo sistemático
D. Muestreo adaptativo



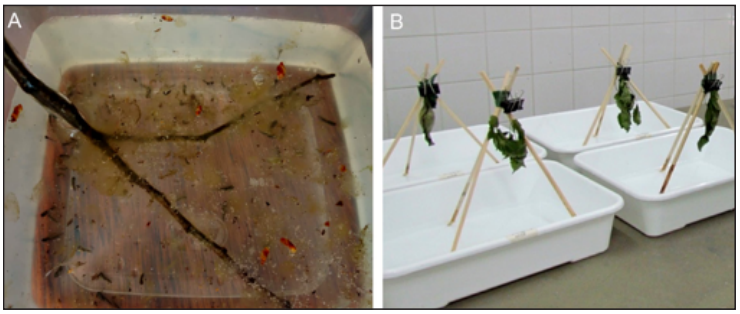
Variación e la **detectabilidad:**

- Historias de vida
- Variación circadiana
- Fenología
- Tipos de ambientes

Relevamiento de la diversidad

1- Oviposturas y embriones

Colecta y mantenimiento de oviposturas



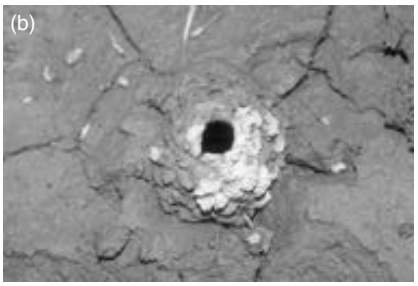
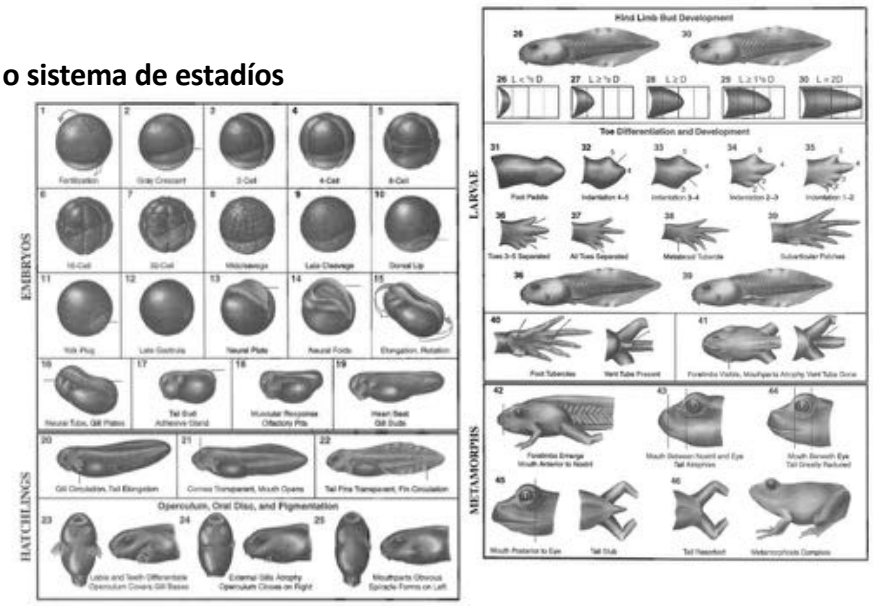
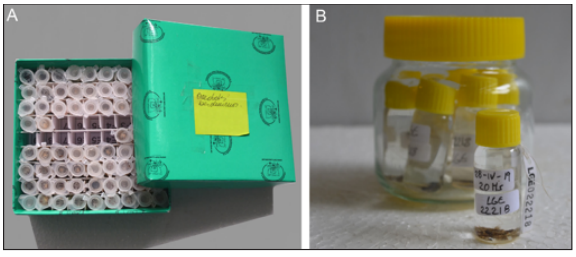


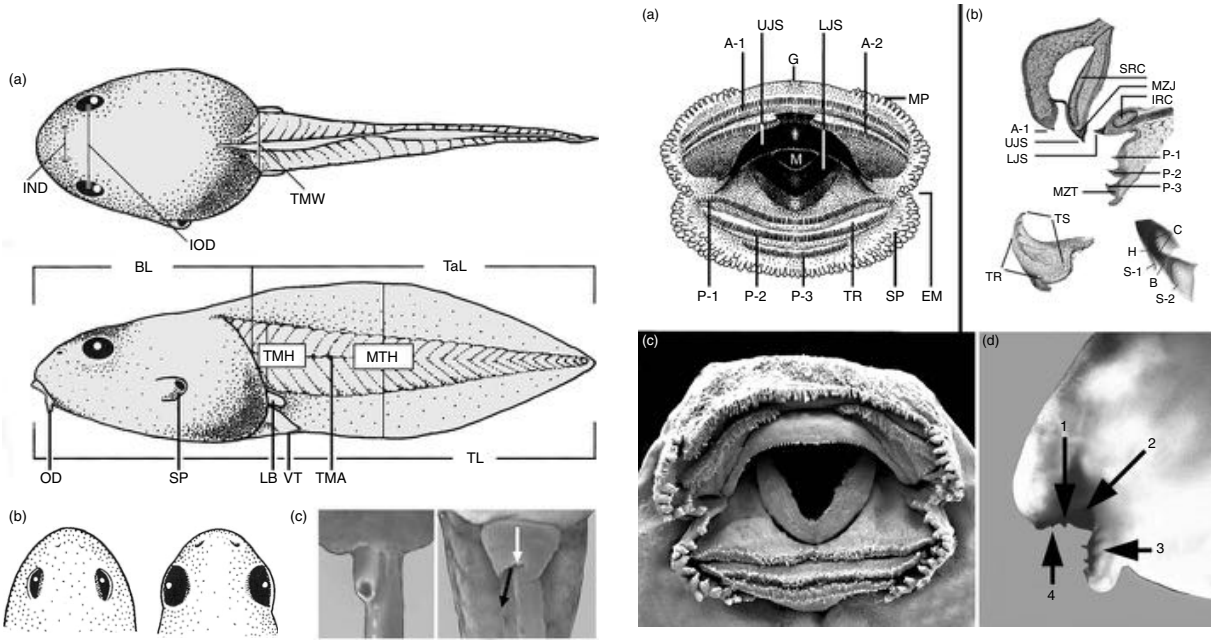
Tabla de Gosner (1960) o sistema de estadíos



Morfometría de renacuajos

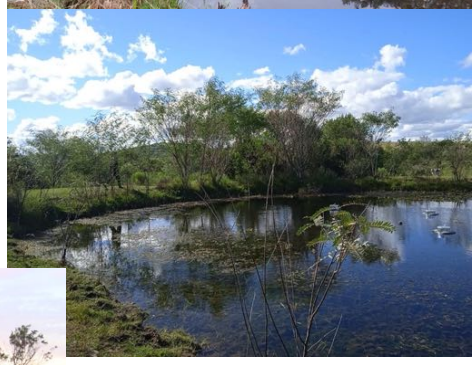


Morfometría de renacuajos



2- Colecta de renacuajos

Del estadío 25 de Gosner
branquias externas son reabsorbidas
Hasta el 41 de Gosner
erupción de los miembros anteriores en el clímax metamórfico



Técnicas de muestreo activo

- **Redes**
- **Cajas trampa**
- **Encuentros visuales**

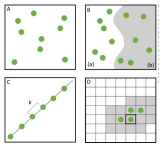
Técnicas de muestreo pasivo

- **Redes simples (bollas y plomos, ancho de maya)**
- **Trampas de embudo (nasa)**

3- Relevamiento de postmetamorfos (juveiles o adultos)

Técnicas de muestreo activo

- **Muestreo por encuentros visuales**



Supuestos:
i) todos los individuos de las distintas especie tienen la misma probabilidad de ser encontrados.
ii) cada individuo es detectado una única vez en la búsqueda.

3- Relevamiento de postmetamorfos (juveiles o adultos)

Técnicas de muestreo activo

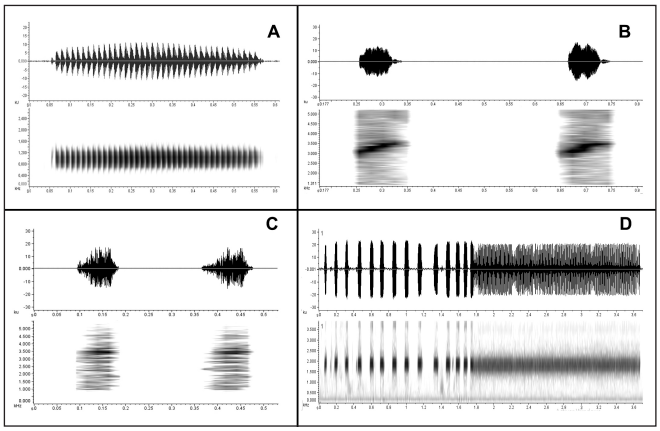
- **Muestreo por registros auditivos**

Canto especie-específico

a) Muestreo auditivo
Categorías de abundancia
- Ocacional
- Raro
- Común
- Abundante

b) Registros sonoros

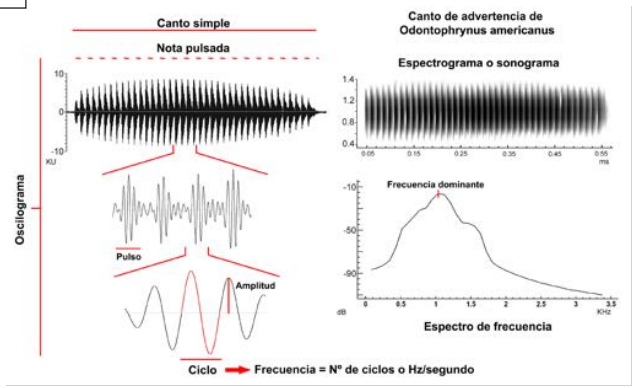
3- Relevamiento de postmetamorfos (juveiles o adultos)



Oscilograma

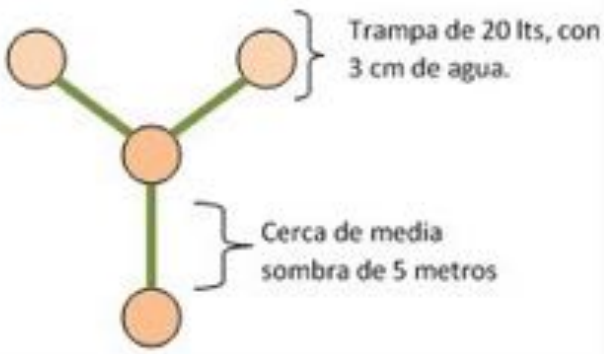
Espectrograma

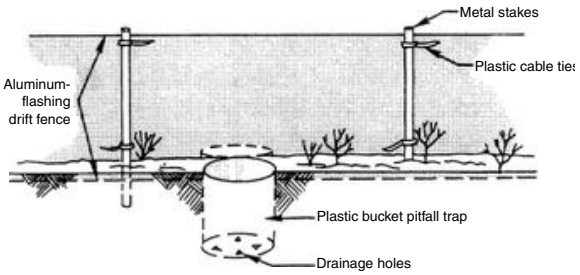
(A) canto simple pulsado de *Odontophrynus americanus*
(B) serie de dos cantos simples tonales de *Leptodactylus latinasus*
(C) serie de dos cantos simples pulsáti- les de *Scinax nasicus*
(D) canto compuesto o complejo de *Melanophryniscus stelzneri*, con series de notas tonales en la primer mitad del canto y un tren de pulsos en la segunda mitad.

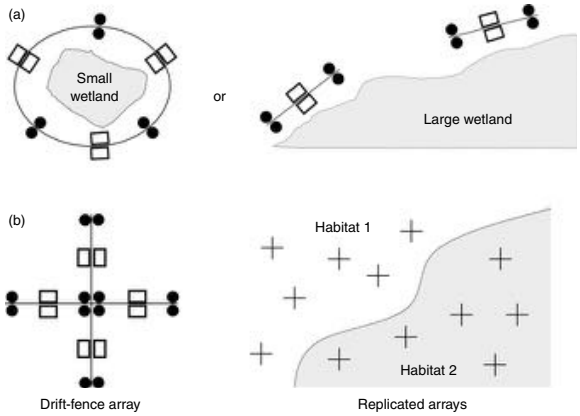


Técnicas de muestreo pasivo

Trampas de caída y cercos de deriva



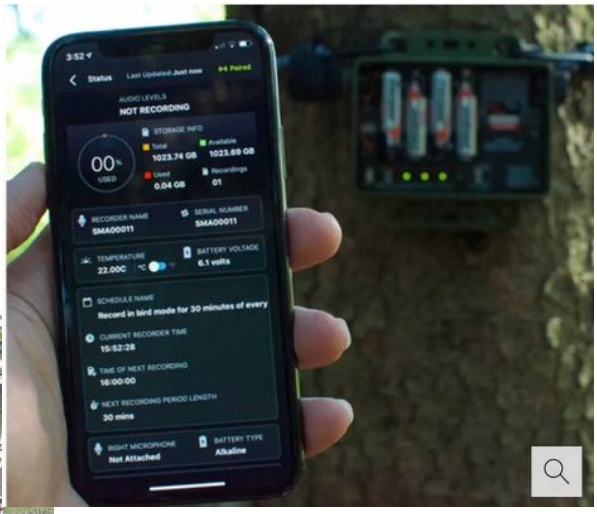




Cubiertas y refugios artificiales

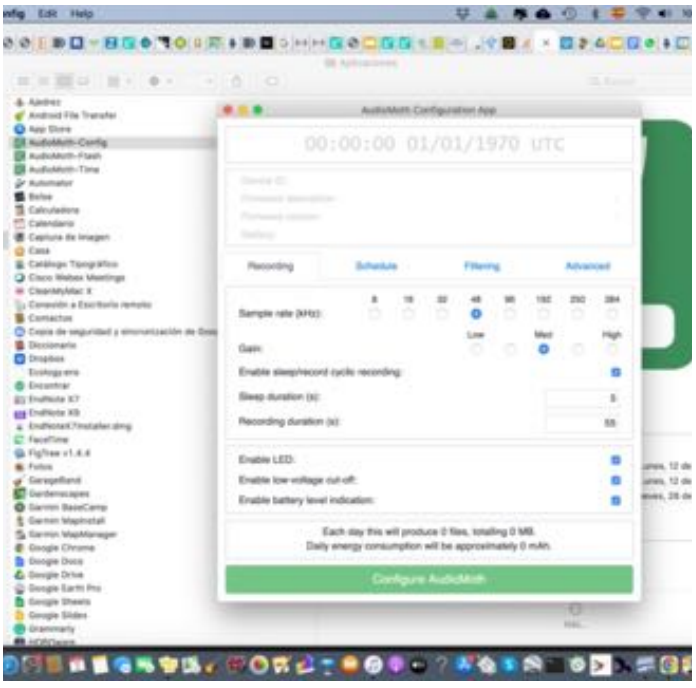
Monitoreo o muestreo acústico pasivo (MAP)

grabadores digitales automatizados (GDA)



Monitoreo o muestreo acústico pasivo (MAP)

grabadores digitales automatizados (GDA)



Programación/Horarios de los Grabadores Digitales Automatizados

Tasa de Muestreo (Sampling Rate, 16000 Hz)

Gasto de baterías y almacenamiento

Permite:
- muestreos a largo plazo
- sincronicos espacialmente

Equipos costosos
Manejo de la información

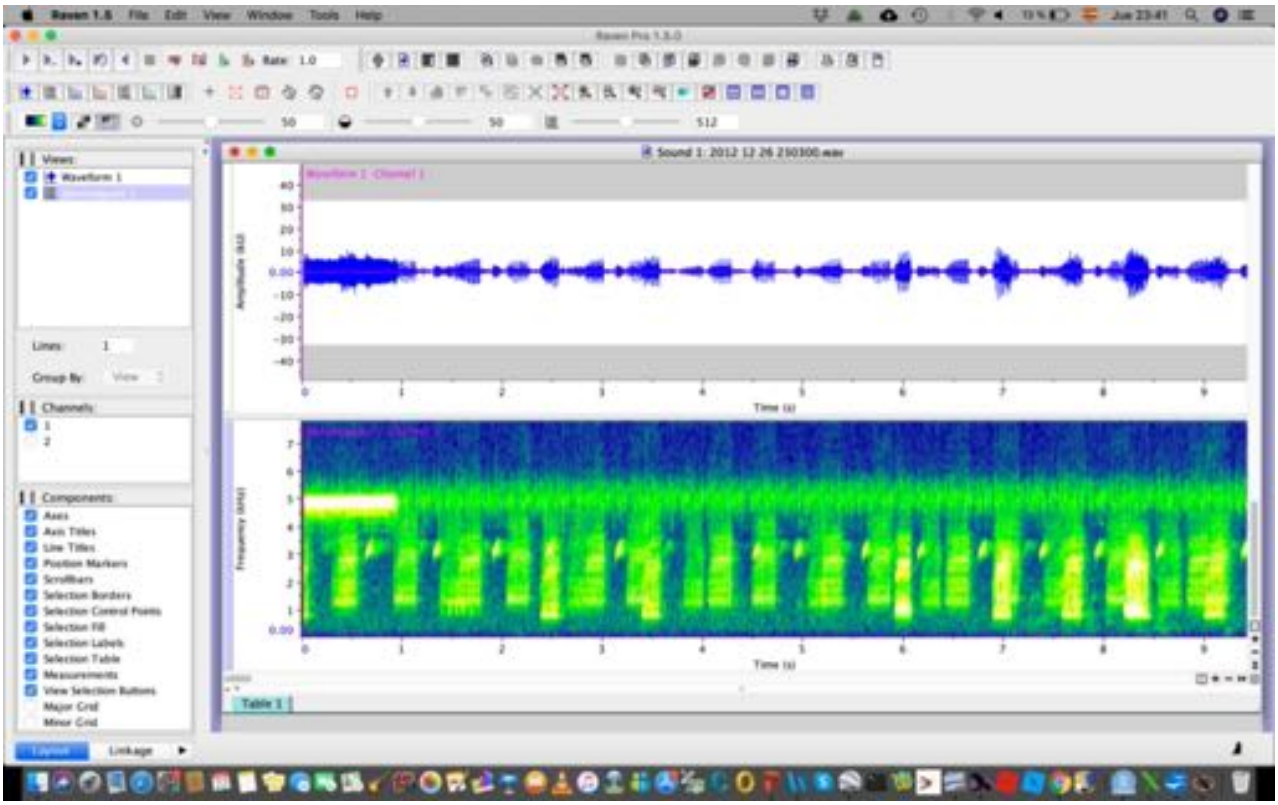
Bioacústica

Ecoacústica

Paisaje acústico: índices acústicos

-NDSI proxy de ruido
(Fairbrass et al. 2017)

ACI, ADI, AEI, H and BIO



Raven Interactive Sound Analysis Software — The Cornell Lab of Ornithology Bioacoustics Research Program

seewave

Audacity

Soundscape Ecology

Acoustic Template Detection in R

Documentation for package 'monitoR' version

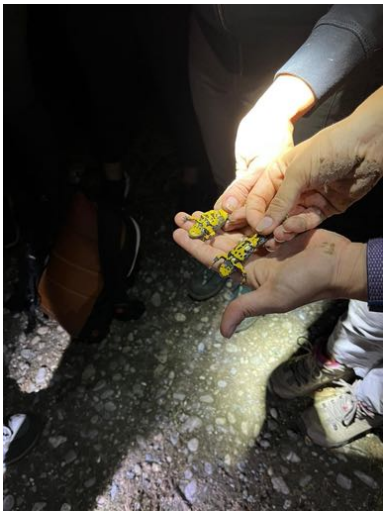
WILDLIFE ACOUSTICS

Kaleidoscope Pro 5

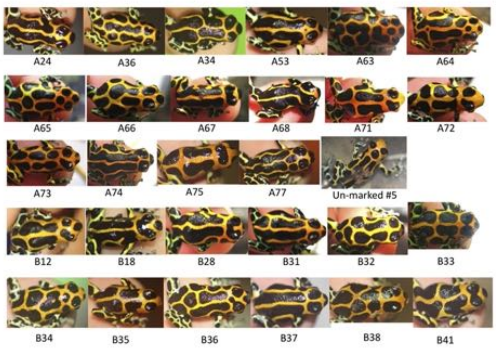
Estudios específicos

Identificación y marcaje de individuos

1.Técnicas de identificación por manchas y patrones de la piel



Bombina variegata



South American Journal of Herpetology, 11(2), 2016, 119–126

Movement Patterns in a Uruguayan Population of *Melanophryniscus montevidensis* (Philippi, 1902) (Anura: Bufonidae) Using Photo-Identification for Individual Recognition

***Gisela Pereira*[1,*], *Raúl Maneyro*[1]**

[1] *Laboratorio de Sistemática e Historia Natural de Vertebrados. Instituto de Ecología y Ciencias Ambientales. Facultad de Ciencias, Universidad de la República. Iguá 4225, CP 11400, Montevideo, Uruguay.*
[*] *Corresponding author. Email: gisepe04@gmail.com*

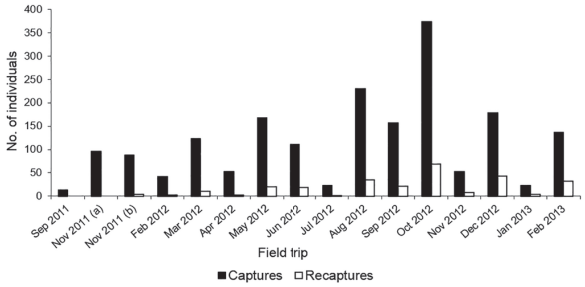


Figure 2. Monthly variation in the number of captured and recaptured individuals of *Melanophryniscus montevidensis* at Barra de la Laguna de Rocha.

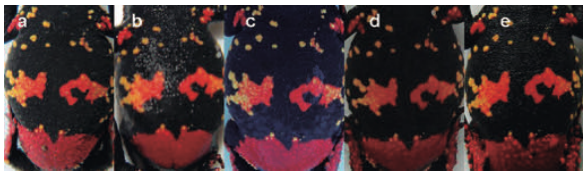
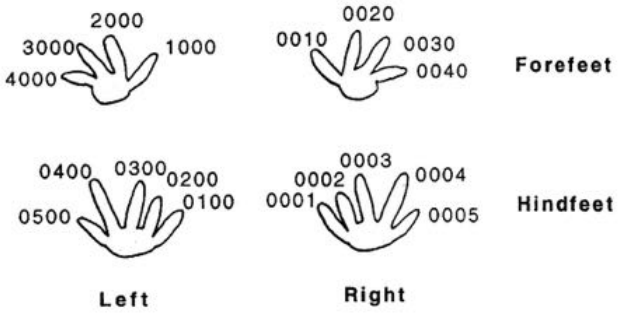
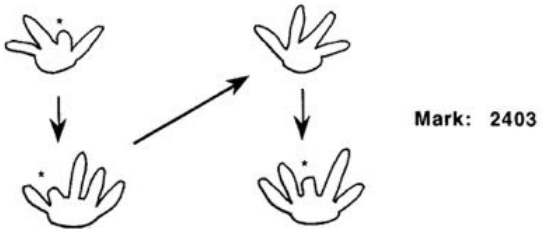


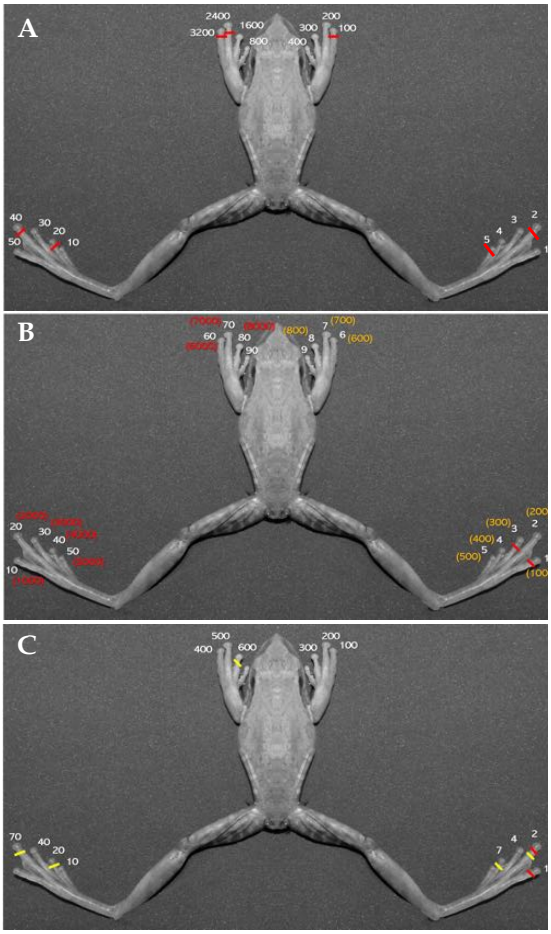
Figure 3. Male of *Melanophryniscus montevidensis* recaptured four times in Barra de la Laguna de Rocha during the period of work. **(a)** First capture: July 2012, shelter in C1. **(b)** Recapture (RC) 1: August 2012, breeding activity in C2t. **(c)** RC 2: September 2012, active in C2t. **(d)** RC 3: October 2012, breeding activity in C2t. **(e)** RC 4: December 2012, breeding activity in C2t. Photos: Federico Achaval-Coppes, Santiago Cruces, Ernesto Elgue, and Gisela Pereira.

Técnicas de marcado

1. Corte de falanges

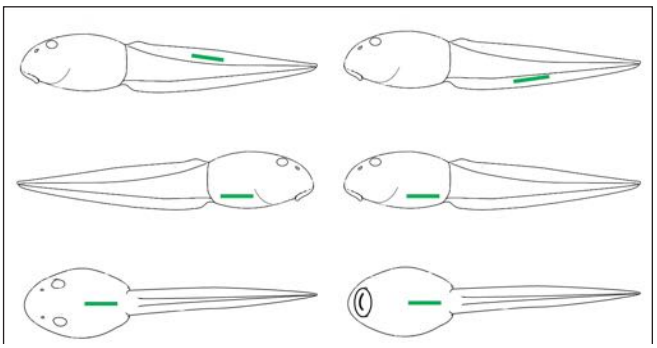




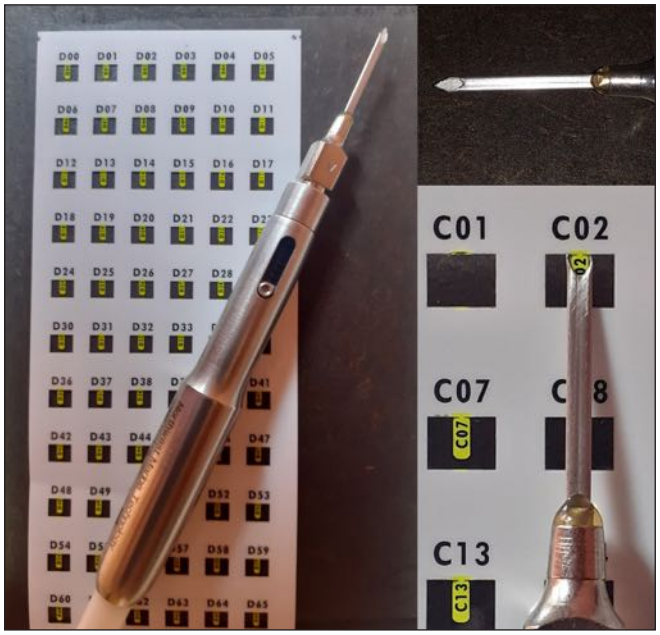


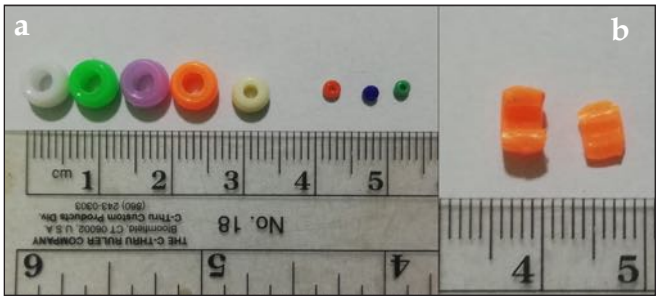
Etiquetas electrónicas pasivas internas (Passive Integrated Transponder, PIT)

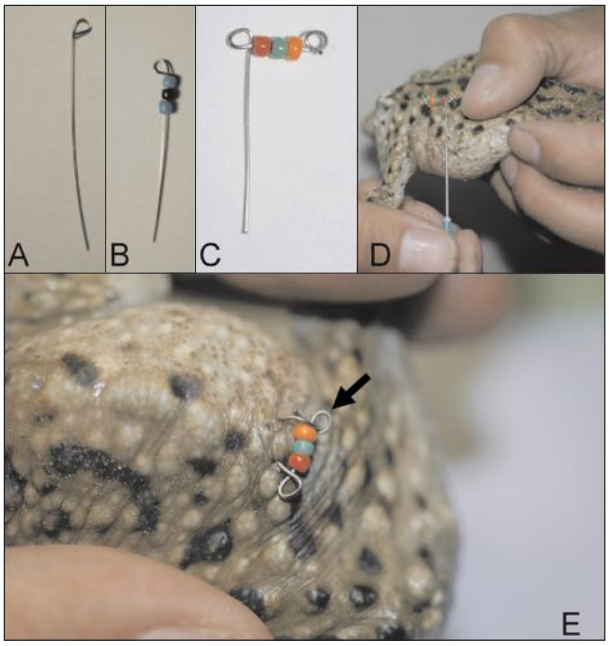
Implante visible de elastómeros (Visual Implant Elastomer, VIE)



Implantes visuales alfanuméricos (Visual Implant Alphanumeric, VIA)



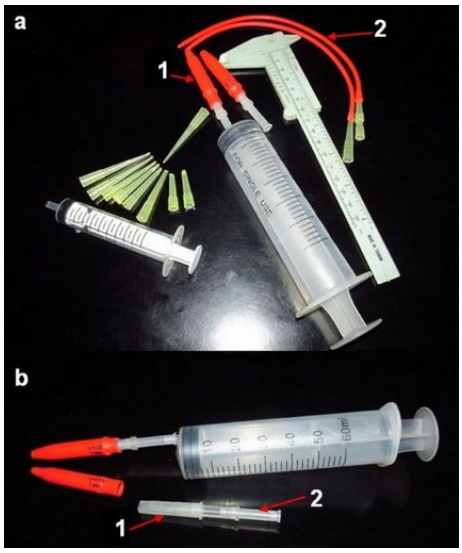


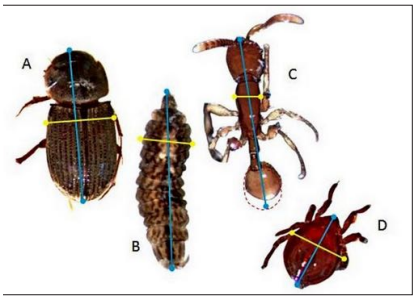


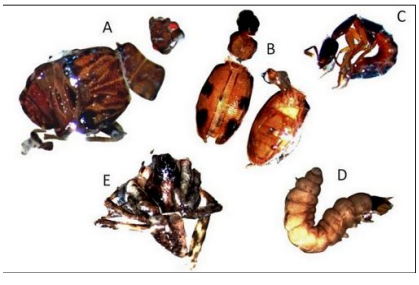
Cinturones y piercings

Color	Primera perla	Segunda perla	Tercera perla (multiplicador)
Negro	0	0	0
Marrón	1	1	10
Rojo	2	2	100
Naranja	3	3	1000
Amarillo	4	4	10000
Verde	5	5	100000
Azul	7	7	1000000
Violeta	8	8	10000000
Gris	9	9	100000000
Blanco	10	10	1000000000

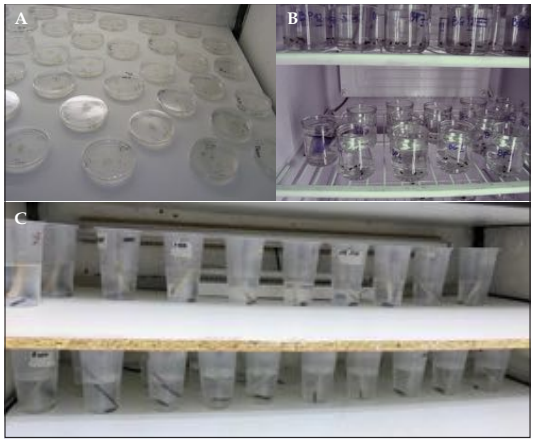
Estudios de dieta







Estudios en microcosmos



Manipulación de organismos:

- Uso de guantes lavados

Capturas:

- obtener la mayor cantidad de información posible de cada individuo (medidas morfométricas, peso, material genético…)
- Información del ambiente (sustrato, meteorología)
- depositar en colecciones científicas
- Eutanasia (técnico acreditado por la CHEA) utilizando anestésicos (Pentobarbital sódico, Metanosulfonato de tricaína MS-222)

North-Western Journal of Zoology

Vol. 4, No. 1, 2008, pp.29-41
[Online: Vol.4, 2008: 07]

Calling activity patterns in an anuran assemblage: the role of seasonal trends and weather determinants

Andrés CANAVERO[1,2,*], Matías ARIM[2,3], Daniel E. NAYA[3],
Arley CAMARGO[2,5], Inés da ROSA[2] and Raúl MANEYRO[2,4]

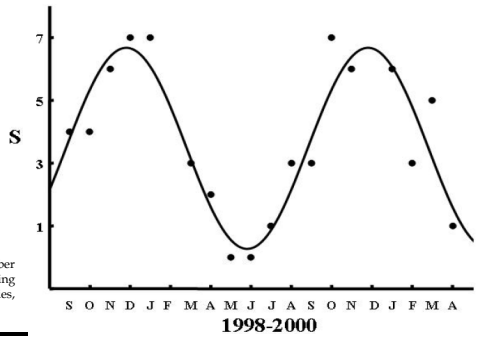
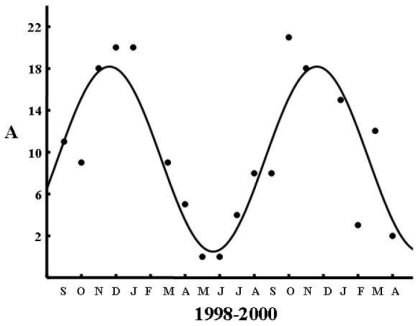


Table 2. Ranks of relative abundance for each species of the anuran assemblage at Espinas Stream, Maldonado, Uruguay, from September 1998 to April 2000. 1 = one calling male, 2 = two or three calling males, 3 = more than three calling males with calls being distinguishable from each other, 4 = chorus, S = number of species calling, A = sum of the estimated abundances of all active species, Nº = number of different months where the species was registered (in a 12 months scheme).

	1998				1999										2000				
Species	S	O	N	D	J	M	A	M	J	J	A	S	O	N	J	F	M	A	Nº
Hypsiboas pulchellus	4	2	4	4	4	4	4			4	4	3	3	3	4	1	4	2	10
Pseudis minuta	2	2	3	2	2	4	1				3	1	3	3	2	1	1		8
Physalaemus gracilis	4	4	4	4	3						1	4	4	4	3		1		7
Scinax granulatus	1		3		1								4	2	1				4
Leptodactylus latinasus		1	1										3	4	3	1			4
Leptodactylus ocellatus			3	2	4	1							3						5
Leptodactylus gracilis													1	2	2				3
Elachistocleis bicolor				2	2												2		3
Odontophrynus americanus				2													4		2
Rhinella gr. granulosus				4	4														2
S	4	4	6	7	7	3	2	0	0	1	3	3	7	6	6	3	5	1	
A	11	9	18	20	20	9	5	0	0	4	8	8	21	18	15	3	12	2	



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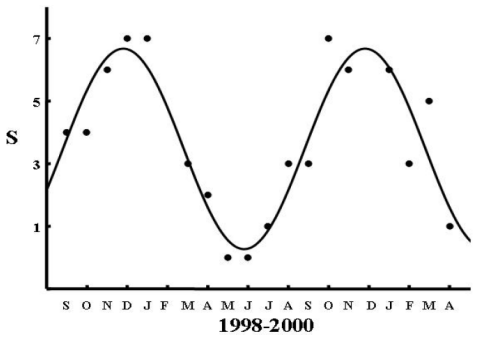
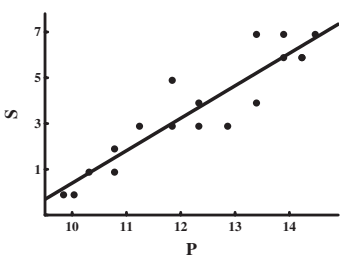


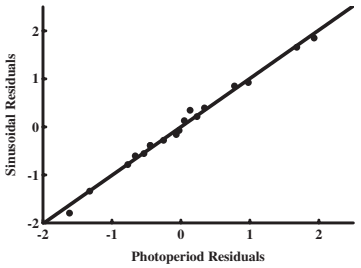
Journal of Natural History
Vol. 43, Nos. 45–48, December 2009, 2975–2984

Taylor & Francis
Taylor & Francis Group

Clues supporting photoperiod as the main determinant of seasonal variation in amphibian activity

Andrés Canavero[a,b]* and Matías Arim[b,c]





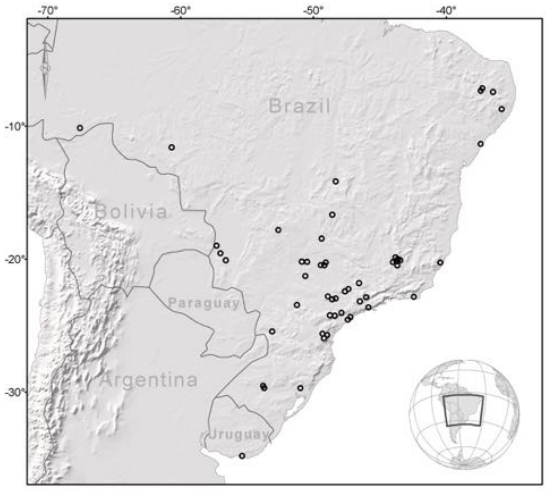
Anuran phenology and the macroecological perspective

Amphibia-Reptilia 26 (2005): 211-221

Breeding activity patterns, reproductive modes, and habitat use by anurans (Amphibia) in a seasonal environment in the Pantanal, Brazil

Cynthia P. de A. Prado[1,3], Masao Uetanabaro[1], Célio F.B. Haddad[2]

Species	Mode	Pattern	Reproductive period
Bufonidae			
Bufo sp. 1 (gr. *granulosus*)	1	E	
Bufo sp. 2 (gr. *granulosus*)	1	E	
B. schneideri	1	E	
Hylidae			
Hyla nana	1	C	
H. punctata	1	P	
H. raniceps	1	P	
Lysapsus limellus	1	C	
Phrynohyas venulosa	1	E	
Phyllo medusa hypochondrialis	18	P	
Pseudis paradoxa	1	P	
Scinax acuminatus	1	E	
S. fuscomarginatus	1	P	
S. nasicus	1	E	
Leptodactylidae			
Adenomera cf. *diptyx*	21 or 22	P	
L. eptodactylus chaquensis	8	E	
L. elenae	21	P	
L. fuscus	21	P	
L. cf. *macrosternum*	8	E	
L. podicipinus	3	C	
Physalaemus albonotatus	8	P	
P. cf. *biligonigerus*	8	E	
Pseudopaludicola cf. *falcipes*	1	E	
Microhylidae			
Chiasmocleis mehelvi	1	E	
Elachistocleis cf. *bicolor*	1	E	
		Months	J F M A M J J A S O N D



52 comunidades
9-39 especies
361 especies
50 géneros
7º a 35º S

Metabolic theory of ecology

PERSPECTIVES
THE ROBERT H. MACARTHUR AWARD LECTURE

Ecology, 85(7), 2004, pp. 1771–1789

TOWARD A METABOLIC THEORY OF ECOLOGY

JAMES H. BROWN,[1,2,4]
with JAMES F. GILLOOLY,[1] ANDREW P. ALLEN,[1] VAN M. SAVAGE,[2,3] AND GEOFFREY B. WEST[2,3]

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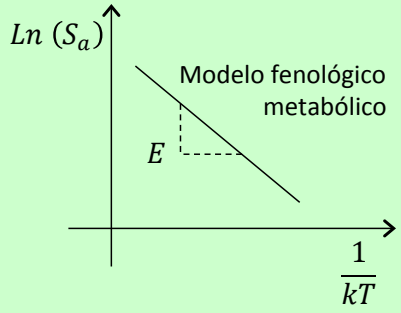
$$B_T \approx e^{\frac{-E}{kT}}$$

E = activation energy (eV)
k = Boltzmann constant (8,62x10^{-5} eV/K)
T = temperature in Kelvin



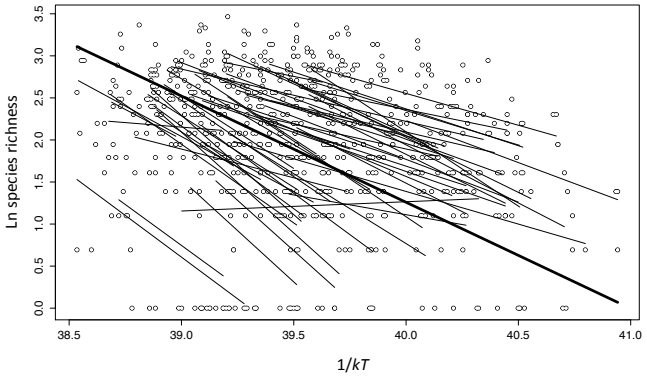
$$S_a \approx C \times e^{\frac{-E}{kT}}$$

$$Ln\,(S_a) \approx C_1 - E\,\frac{1}{kT}$$

(Allen et al. 2002, 2007, Algar et al. 2007, Hawkins et al. 2007a,b, Latimer 2007, Gillooly & Allen 2007, Munch & Salinas 2009)

Results

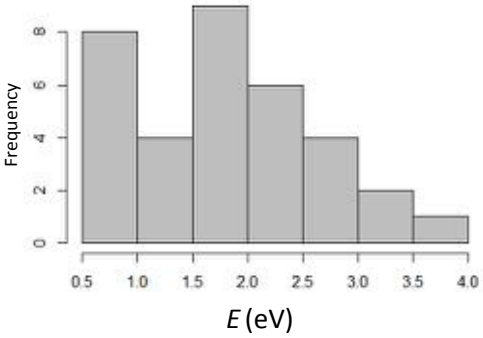
Mixed effect linear model
Number of observations: 717
Number of groups (communities): 52

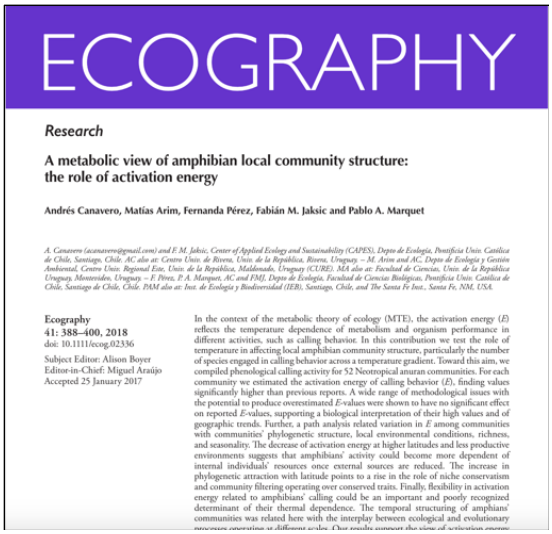


The analysis of slopes (E) is of interest as a biological variable representing the thermal dependence of communities phenology.

Test Shapiro-Wilk de normalidad:
W = 0,957; p-value = 0,204

Media = 1,80 eV (IC = 1,53 a 2,08 eV)





ECOGRAPHY

Research

A metabolic view of amphibian local community structure: the role of activation energy

Andrés Canavero, Matías Arim, Fernanda Pérez, Fabián M. Jaksic and Pablo A. Marquet

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Ecography
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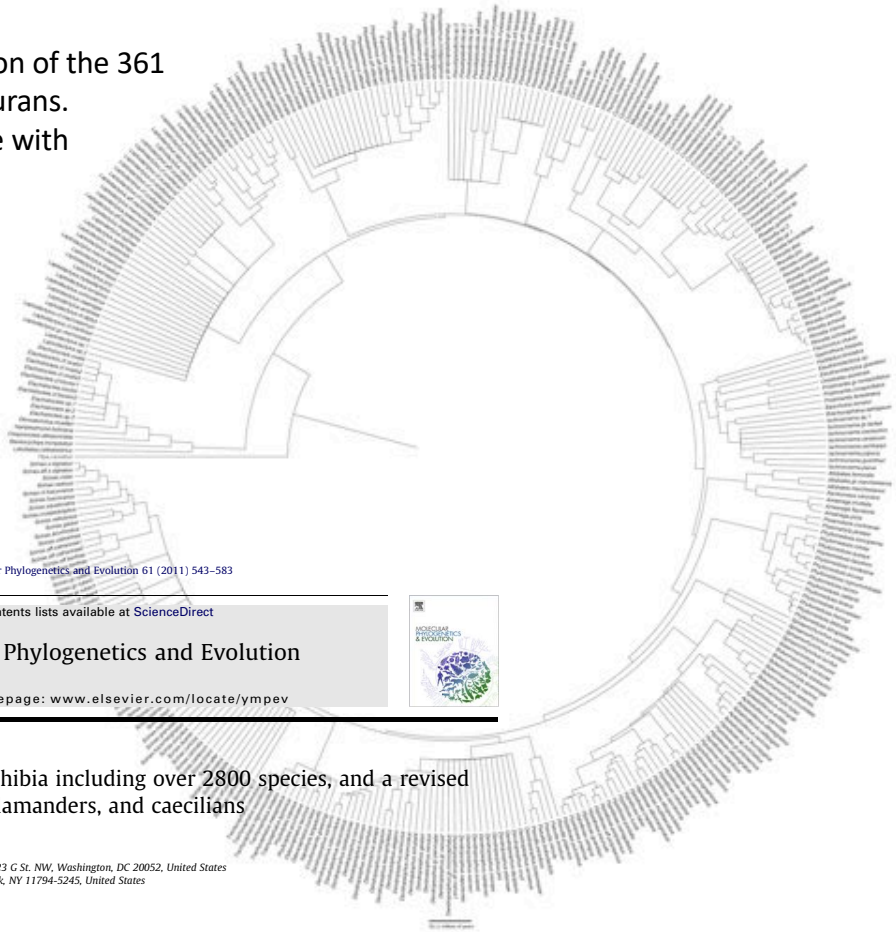
Accepted 25 January 2017

In the context of the metabolic theory of ecology (MTE), the activation energy (*E*) reflects the temperature dependence of metabolism and organism performance in different activities, such as calling behavior. In this contribution we test the role of temperature in affecting local amphibian community structure, particularly the number of species engaged in calling behavior across a temperature gradient. Toward this aim, we compiled phenological calling activity for 52 Neotropical anuran communities. For each community we estimated the activation energy of calling behavior (*E*), finding values significantly higher than previous reports. A wide range of methodological issues with the potential to produce overestimated *E*-values were shown to have no significant effect on reported *E*-values, supporting a biological interpretation of their high values and of geographic trends. Further, a path analysis related variation in *E* among communities with communities' phylogenetic structure, local environmental conditions, richness, and seasonality. The decrease of activation energy at higher latitudes and less productive environments suggests that amphibians' activity could become more dependent of internal individuals' resources once external sources are reduced. The increase in phylogenetic attraction with latitude points to a rise in the role of niche conservatism and community filtering operating over conserved traits. Finally, flexibility in activation energy related to amphibians' calling could be an important and poorly recognized determinant of their thermal dependence. The temporal structuring of amphians' communities was related here with the interplay between ecological and evolutionary

Phylogenetic reconstruction of the 361 species of Neotropical anurans. Estimated ultrametric tree with Maximum Likelihood.



Molecular Phylogenetics and Evolution 61 (2011) 543–583

Contents lists available at ScienceDirect

Molecular Phylogenetics and Evolution

journal homepage: www.elsevier.com/locate/ympev

A large-scale phylogeny of Amphibia including over 2800 species, and a revised classification of extant frogs, salamanders, and caecilians

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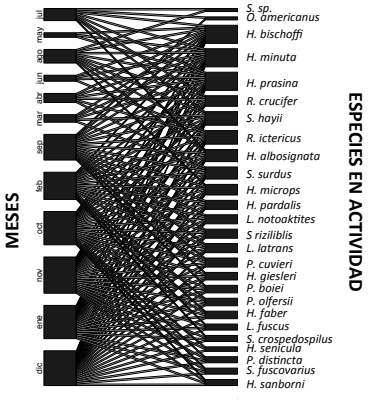
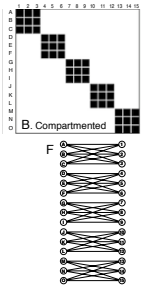
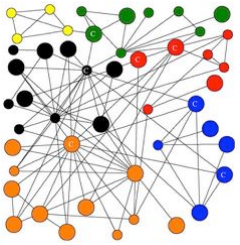
Network theory

Phenological modularity (ZMod):
It represents the degree to which some species are more likely to share months in which they are active.



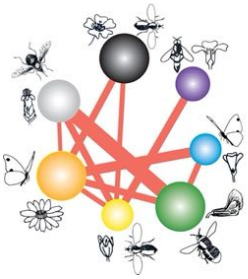




Robert May

Will a Large Complex System be Stable?

NATURE VOL. 238 AUGUST 18 1972



Modularity has been associated with stability.
(May 1972, Thébault & Fontine 2010, Clune et al. 2013).

(Lewinsohn & Prado 2006, Olesen et al. 2007, Canavero et al. 2009, Fortuna et al. 2009, Borthagaray et al. 2014a,b)

Austral Ecology A Journal of ecology in the Southern Hemisphere

Austral Ecology (2019) **44**, 1451–1462

Phenological modularity in amphibian calling behaviour: Geographic trends and local determinants

ANDRÉS CANAVERO,[1,2]* MATÍAS ARIM,[2] FERNANDA PÉREZ,[3] FABIAN M. JAKSIC[1,3] AND PABLO A. MARQUET[3,4,5]
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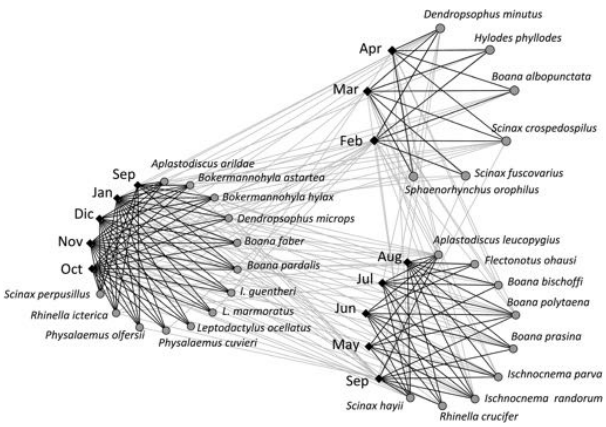
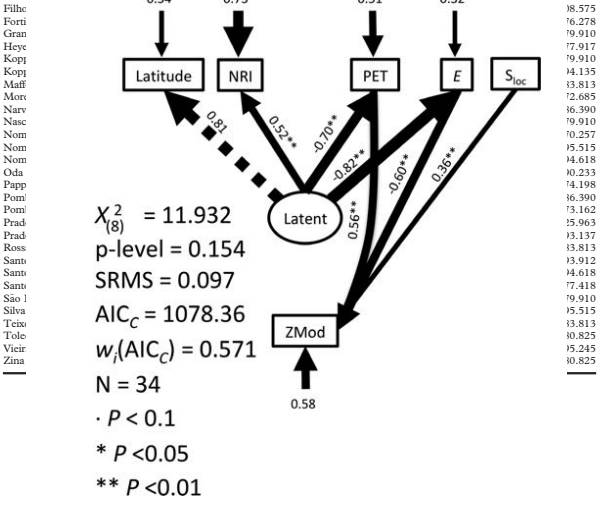


	Locality	S_{loc}	E	ZMod	NRI	PET
Abrunhosa *et al.* (2006)	22°50′S; 42°27′W	19	2.319	1.64	0.481	82.002
Afonso and Eterovick (2007)	20°05′S; 43°29′W	12	0.623	3.51	0.848	79.910
Arzabe (1999)	07°17′S; 37°21′W	11	3.524	−1.05	−0.687	103.820
Arzabe (1999)	07°11′S; 37°19′W	16	3.257	−0.13	−1.260	103.820
Arzabe *et al.* (1998)	11°20′S; 37°25′W	17	−1.033	5.22	−0.512	115.073
Ávila and Ferreira (2004)	18°58′S; 57°39′W	15	2.562	−0.80	−0.823	126.480
Bernarde and dos Anjos (1999)	23°27′S; 51°15′W	18	0.754	2.24	0.457	81.373
Bernarde and Kokubum (1999)	21°16′S; 50°37′W	19	1.735	0.14	−0.186	98.930
Bernarde and Machado (2000)	25°27′S; 53°07′W	20	0.997	−1.57	−1.647	69.233
Bernarde (2007)	11°35′S; 60°41′W	33	0.354	6.63	0.033	87.138
Bertoluci and Rodrigues (2002)	23°38′S; 45°52′W	28	0.951	4.23	2.462	77.917
Bertoluci (1998)	24°15′S; 48°24′W	26	0.978	3.54	1.974	73.162
Blamires *et al.* (1997)	16°39′S; 48°36′W	13	1.476	2.57	0.443	85.403
Borges and de Freitas Juliano (2007)	17°47′S; 49°23′W	25	2.318	4.14	−1.032	97.730
Both *et al.* (2008)	29°32′S; 53°47′W	18	0.859	−0.78	−0.335	77.418
Canavero *et al.* (2008)	34°47′S; 55°22′W	10	0.674	2.31	−1.325	68.460
Candeira (2007)	20°20′S; 49°11′W	24	3.181	−2.81	−1.293	95.515
Canelas and Bertoluci (2007)	20°05′S; 43°28′W	32	1.606	6.80	1.321	79.910
Cardoso and Haddad (1992)	21°48′S; 46°35′W	19	1.657	−0.76	−0.650	74.593
Cardoso and Souza (1996)	10°08′S; 67°35′W	31	2.598	−0.72	1.848	119.998
Conte and Machado (2005)	25°57′S; 49°13′W	21	1.682	0.50	1.883	66.385
Conte and Rossa-Feres (2006)	25°41′S; 49°03′W	31	0.847	2.51	0.836	66.385
Cont						66.385
Filh						88.575
Forti						76.278
Gran						79.910
Heye						87.917
Kopp						79.910
Kopp						84.135
Maff						83.813
Mor						72.685
Narv						86.390
Nasc						79.910
Nom						70.257
Nom						85.515
Nom						84.618
Oda						80.233
Papp						74.198
Pom						86.390
Pom						73.162
Prad						85.963
Prad						83.137
Ross						83.813
Sant						83.912
Sant						84.618
Sant						87.418
São						79.910
Silva						85.515
Teix						83.813
Tole						80.825
Vieir						85.245
Zina						80.825



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Calling phenology of anurans in a tropical rainforest in South Mexico: testing predictive models

Diana Laura Fuentes-de la Rosa[a], Leticia Margarita Ochoa-Ochoa[a] and Andrés Canavero[b]

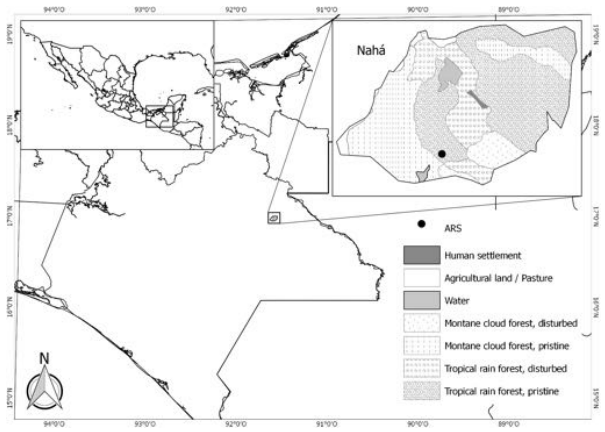
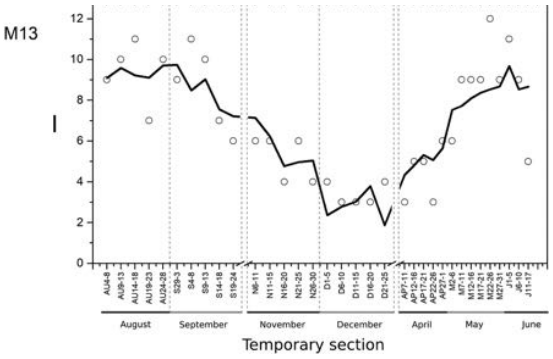


Figure 1. Study site location and land use, natural protected area of Nahá, Ocosingo, Chiapas, México.



$$I \sim lme+lamp*\sin(2\pi(t + c)/72)+D*R_a+E*DW$$